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STRATEGY RESEARCH PROJECT

INFORMATION WARFARE FORCE XXI SITUATIONAL AWARENESS

BY

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Information Warfare

Force XXI Situational Awareness

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U.S. Army War College CARLISLE BARRACKS, PENNSYLVANIA 17013

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ABSTRACT

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The 80's saw the introduction of stovepipe digital architectures in the primary combat arms branches (Aviation, Armor, Artillery, and Infantry) weapon systems. Some of these systems were not interoperable due to their unique software protocols. Aviation and Artillery platforms were interoperable since they utilized the same protocol. In the 90's, General Sullivan expounded on his Force XXI vision to digitally link all the combat arms horizontally and vertically to increase situational awareness. The materiel and combat developments communities produced an internet type system for the combat arms to provide situational awareness. An appliqué system was installed on some of the platforms so the weapons systems could digitally communicate within the internet. The appliqué system proposed to solve the stovepipe architectures will not work. Each combat arms system (AH-64D, M1A2 Abrams, M3 Bradley, Paladin/Crusader) has limited space, weight, and power constraints which prevent the integration of the appliqué system. The Army Acquisition Executive must charter a Project Manager with adequate resources to fully integrate an open architecture system with one operating system tailored into each platform. The Army can not meet the situational awareness objective of Force XXI with another stand alone, federated appliqué system.

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FORCE XXI SITUATIONAL AWARENESS

The Army's fundamental charter is to fight and win the nation's wars and protect America's vital interests around the globe. The multipolar geopolitical world, which has succeeded a half-century of uneasy bipolar stability, presents the Army with a totally new problem set. Adjustments to Cold War force structures, doctrine and technology have sufficed, in the short run, to deal with myriad new military situations. For the long run, however, we must transform the world's preeminent 20th-century land force into the world's preeminent 21st-century land force. This new Army is "Force XXI."

-General Gordon R. Sullivan, US Army

General Sullivan is widely recognized as establishing the vision for the transformation to a digitized Army. There are numerous reasons for this transformation. The world is changing from an Industrial Age to an Information age. Congress is pressuring the Army to downsize, therefore, paradigms of the old way of doing business must change. Many of the old weapons systems components the Army utilizes are no longer manufactured in the commercial market place. As the commercial market place has transitioned to the electronic age, the Army must make a comparable transformation.

General Sullivan looked to the future of the Army after evaluating the problems the Army faced during Operation Desert Storm. He realized the Army must reorganize around information.

He realized the Army should capitalize on the digital revolution in military affairs and propitiate the situational awareness problem that has plagued combat operations for centuries. "In a combat environment, winning the information war—exchanging information horizontally and vertically—will enable battle commanders, fire supporters, logisticians and transporters to share a common, real-time situational awareness" (collecting, integrating, and displaying a common picture of the battlefield that is consistent in both time and space at each user display.

THE CHALLENGE OF SITUATIONAL AWARENESS

The Army faces a difficult, complex task of transforming its stovepipe legacy systems (Abrams tank, Bradley fighting vehicle, Field Artillery systems, and Aviation systems) to an integrated force sharing one picture of the battlefield. The current solution to install a stand alone appliqué system on each legacy system is unacceptable. If the digital solution is not fully integrated into the legacy systems mission architectures and displayed on resident system displays, the Army will never fully achieve situational awareness.

To understand the problems the Army faces with attempts to digitize these primary combat forces, we must look at a brief, languid history of the development of the digital systems.

THE HISTORY OF DIGITAL COMMUNICATIONS

The ability to conduct digital communications is not new to the Army. During the 70's and 80's the TACFIRE digital communications system was developed and fielded to the OH-58D Army Helicopter Improvement Program (AHIP) and the Field Artillery. The AHIP and Field Artillery Fire Direction Centers had the incipient, embedded capability to communicate digitally. The Aviation and Field Artillery platforms utilized the same protocols and message sets to digitally transmit data. From a materiel development standpoint, the systems were very effective. From a training and doctrine standpoint the nascent system did not function effectively. The soldiers who were trained on the system were frequently frustrated by their inability to establish digital communications and corresponding inability to pass fire missions via this system. "The airborne target handoff system (ATHS) ... did not function properly during this test, and it was found to be cumbersome to use and increased the observer workload (para 2.8.8)."4

The Test and Evaluation Command (TECOM) proved conclusively in a laconic, technical test environment that the above system could eliminate confusion, and increase speed and efficiency of message transmission. It was through this TECOM test that the Army saw its first conclusive demonstration of the synergistic affect of information technology. However, in the initial operational test environment the soldiers failed to prove the system was effective or suitable for its intended mission.⁵

In response to the digital communications problems which surfaced during the operational and technical testing, the Training and Doctrine Command (TRADOC) developed an indepth training program at Ft. Sill. Here Field Artillery Second Lieutenants and enlisted aerial observers underwent a six week training program on digital TACFIRE communications. The aerial observers were submitted to a rigorous academic and flight training program. They flew daily in an AHIP and configured the TACFIRE communications system to affect instantaneous connectivity between the aviation platform and the Field Artillery Fire Direction Center. This training proved effective and overcame the hurdles of properly configuring the complex TACFIRE digital communications system.

The AHIP program was suffering many other technical problems. As a result, senior leadership was more concerned with eschewing the program than capitalizing on the embryo stage of the digital age. Due to budgetary considerations, another blow was dealt to the AHIP program. The AHIP training detachment at Ft. Sill was restationed at Ft. Rucker. This decision did not seem to have any far reaching impact to the Army at the time.

Years later, though, one could argue that by eliminating this training at Ft. Sill, TRADOC killed the possibility of maturing this digital system and masked many of the problems that we still face today when attempting to communicate digitally with the Artillery. In our infancy stages of attempting to make a digital program work, we opted for the easy solution and stopped the program.

As a result, there was little if any digital connectivity during training exercises between Aviation and Field Artillery units. Within the Field Artillery units and within AHIP equipped Aviation units, "intra-unit" digital communications were effective. In-depth digital tactics, techniques, and procedures (TTP) were developed and widely practiced for intra-unit communications, but little if any "inter-unit" work was performed. Commanders at all levels could not visualize the future and the power of information dominance. As a result,

TRADOC and the materiel developer community did not work together to inculcate a vision of digital connectivity. This contretemps was the start of the "stovepipe" solutions that continue to plague the Force XXI progress.

Another example of an early opportunity lost was the development of the Intervehicular Information System (IVIS) for the Abrams Main Battle Tank (M1A2 tank) and the M3 Bradley Fighting Vehicle. The IVIS system was developed to provide an information system for Armor and Infantry Battalions. This system is a very effective situational awareness tool for all vehicles equipped with the IVIS system. It concatenates critical graphics, command and control message sets, and provides the tank and vehicle commander a pictorial view of all systems entered into the net. Unfortunately, the IVIS system was developed in a stovepipe manner with little consideration for connectivity to other Battlefield Functional Areas (BFA).

The IVIS architecture was a closed system with no connectivity to the TACFIRE system utilized by the OH-58D AHIP program or the Field Artillery systems. Once again, the Army had developed a digital system in the 80's with little if any vision for the future battlefield and information dominance. By all measures of a successful acquisition system, the M1A2 system with its IVIS digital architecture was a very effective and suitable

program. However, in the context of the vision for future information dominance, the Army had created another stovepipe system with no ability to share situational awareness via an "internet" architecture.

The AH-64D Longbow Apache program took a different approach. It developed an architecture which had the flexibility to adapt new protocols in an attempt to minimize the effect of stovepipe systems. This architecture is capable of installing BFA protocol cards into the communication system. As a result, the AH-64D is capable of communicating digitally with Air Force aircraft utilizing the Air Force protocol, with the Field Artillery and its new protocol, and with the Marine Corps with their stovepipe protocol. No attempt was made to design connectivity with the IVIS system.

It is critical to understand the development of the major combat platform stovepipe digital systems to understand the underpinnings of the problems we face today as we struggle to digitally connect the Force XXI systems.

DEFENSE ACQUISITION BOARD APPROVED PROGRAMS

The reason this background is so important to understand is because of its current impact on the alacritous progress of the Force XXI effort. As the Army departed the 80's, the OH-58D

Kiowa Warrior, AH-64D Longbow Apache, M1A2 Abrams Tank, and the Bradley Infantry Fighting Vehicle were approved major defense acquisition programs. This meant the programs had successfully passed a Defense Acquisition Board (DAB) process and were approved for production by the Army Acquisition Executive. These complex architectures were in various stages of development, but the system specification and programmatic funding were approved by the DAB. Thus, barring any catastrophic deficiencies identified during testing which required reengineering, the system capabilities and architectures were fixed.

This presented another obstacle to adopting digital interoperability. Since the system architecture was approved by the DAB, the expectation was that the systems would roll off the assembly line on time, within budget, and meet the performance specified by TRADOC. Each system digitally communicated with "intranet" protocol systems but could not communicate via an "internet" across different protocols.

As the Army emerged into the 90's, the materiel development system was rife with branch specific closed architectures. The primary reason for this disaster was the lack of a vision from the TRADOC community that foresaw the power of digital communications and a potential synergistic solution to situational awareness.

OPERATION DESERT STORM LESSONS LEARNED

The success that each branch was having with their ebullient "intranet" solutions and the fratricide incidents during

Operation Desert Storm are the key events that paved the way for the transformation to the digital focus of the future. "Digital technology is not new to the Army. Over the past few years, upgraded weapon systems have begun to incorporate the capabilities of emerging digital technologies. These upgraded systems gave us speed, flexibility and agility." "The final push began at the end of Operation Desert Storm in 1991, when "friendly fire" incidents emphasized the need for enhanced situational awareness systems in the Army's heavy forces."

The "intranet" solutions demonstrated that situational awareness was enhanced if each platform saw the same picture.

Unfortunately, the "intranet" solution was branch specific with little interoperability between branch platforms. The incidents of fratricide raised the emphasis on developing an interoperable solution between branch platforms. The "intranet" solution and fratricide incidents did not provide enough impetus to fuel the revolution in military affairs that was envisioned on the eve of

the information age. What was missing in the 80's was a clear vision of the future.

THE DIGITAL VISION

Neither the National Security Strategy (NSS) nor the National Military Strategy (NMS) recognized the importance of information until the middle 90's. It is not until the 1995 NMS or the 1997 NSS that one sees the roots of importance of information warfare. These manuscripts produced a literature explosion for information warfare and dominance. Joint Vision 2010 and Army Vision 2010 are the keystone documents that developed the information warfare and dominance themes into programs for the future. Each document eloquently outlines the military's charter for dominance in the 21st century. These documents and the plethora of information that is evolving from the services will aid our struggle to remain on a coordinated Force XXI journey to digitization.

Since the Army got a late start on the digital journey, the materiel and combat development communities will need help to garner support to develop and defend budgets to bring the digital vision to a reality. It is only through the retrospection and epiphany of General Sullivan that we have progressed as far on the Force XXI journey. He is the single, vociferous figure that

planted the seeds for the Army of the 21st century. "General Gordon R. Sullivan, a distinguished soldier and forward-looking manager, shepherded the U.S. Army through its recent changes with minimum fanfare but exceptional effectiveness..."

General Sullivan dedicated his years as the Army Chief of Staff charting the future of the Army and articulating a vision for the soldier skills, technologies, organizations, and doctrine required to meet the challenges as we "evolved into the world's premier 21st—century fighting force." "I articulated a vision: a concept that embraced change, continuity, and growth: and a strategic intent to transform the Army. I stayed personally involved so that I could influence the process." This was the key ingredient missing from the 80's and prevented the capricious digital revolution in military affairs to start then.

The legacy that General Sullivan left the Army and the military forces is an intricate process to shape, prepare, and produce a force capable of responding to the challenges of the future. The development of the process and pursuit of the vision is the visceral responsibility of the Army Digitization Office (ADO). This office is responsible to ensure all efforts (ways and means) are properly integrated within the Army to ensure situational awareness. "The ADO mission is to: advise the Army

Acquisition Executive (AAE) and Vice Chief of Staff, Army (VCSA) on all matters concerning the integration of digital capabilities across the force and oversee the integration of Army digitization activities consistent with guidance from the AAE, VCSA, and Chief of Staff, Army (CSA)."11

ADVANCED WARFIGHTING EXPERIMENTS

The Army is navigating its way through the ubiquitous labyrinth of digital architectures which pervade the primary combat arms branches and is evaluating their effectiveness via numerous advanced warfighting experiments (AWE). The AWEs are supposed to give the leadership an evaluation of the means (resources) we are applying to meet the objective (ends) of seamless situational awareness. A brief look at each of the AWEs demonstrates the challenges the Army faces with developing one common picture of the battlefield.

During March 1993, Ft. Knox sponsored the Battlefield Synchronization Demonstration (BSD). This was the first AWE that exposed the power of information and exhibited situational awareness. It was the culmination of a year's worth of work to connect different protocols into one picture of the battlefield. The OH-58D/Field Artillery TACFIRE system was digitally linked to

the Armor/Infantry IVIS system. Even though only two message sets (situation and spot reports) were transmitted among the different weapon systems, it proved that industry could break the stovepipe protocols paradigm that pervaded the digital environment. The Task Force Battalion Commander could see all his forces entered into his net on his M1A2 Abrams tank digital display. Instead of only having an "intranet" solution, the BSD demonstrated the first "internet" solution. As General Sullivan proclaimed in his book, Hope is not a Method, "he [the task force commander] could take much of the ambiguity and time delay out of traditional man-in-the-loop voice and analogue systems and make it possible for commanders to assess the situation, issue orders, and move decisively with lightning-fast speed and accuracy." 12

This demonstration proved conclusively that the obsequious industry and the materiel developments community could break the branch specific digital protocols and truly integrate information on the battlefield. The TRADOC commander was satisfied with the results of this simple demo. Numerous meetings were held to discuss the success of the BSD. It was universally agreed within the TRADOC community that situational awareness was enhanced, but TRADOC needed to agree on a common message set and picture of the battlefield to pass digitally. The next step in the AWE journey

was to conduct the same experiment at the National Training Center (NTC) during rotation 94-07.

During April 1994, NTC reluctantly sponsored the first digital rotation. NTC was initially reluctant to sponsor a digital rotation from fear of becoming the National TEST Center versus the National TRAINING Center. There was some concern by senior leadership that once experimental equipment was allowed on this unique battlefield, Battalion and Brigade commanders would lose the value of the training experience. TRADOC intervened and the stage was set to conduct the first digital rotation at the National TRAINING Center.

An Armor Battalion task force was equipped with the IVIS solution. The task force Abrams tanks and Bradley Fighting

Vehicles were equipped with the IVIS system. An Aviation

Battalion comprised of an AH-64A TACFIRE equipped section and an OH-58D TACFIRE equipped platoon descended upon the toughest peacetime environment to prove that situational awareness could enhance the opportunity for a Blue force to beat the Red force.

Just prior to the rotation, the Aviation and Armor communities came to a startling revelation.

The Armor community had made changes to the IVIS software dictated from the previous year's BSD. Unfortunately, the IVIS-TACFIRE connectivity was lost in the process. As a result, the

first strenuous test of the Armor, Aviation, Field Artillery, and Infantry digital connectivity on a simulated battlefield was lost. The digital community could not reenact or expand on the success of the previous year's BSD.

ARMY DIGITIZATION OFFICE

As TRADOC discussed the outcome of NTC rotation 94-07, the Army was establishing the Army Digitization Office (ADO). It was readily apparent from the success of March 1993 and the setback of the April 1994 exercise that a Department of the Army organization was required to coordinate all the activities of the digital materiel and requirements development processes.

The April 1994 NTC rotation proved the primary combat arms branches would continue to develop and field parochial digital solutions as required by their specific, stovepipe requirements documents. Without a governing body and dramatic changes to the branch unique requirements documents, the material development community would not produce digital communication systems that were compatible and interoperable.

A commitment by senior leadership was required at this point in the journey to force a coordinated plan to transition the Army into the information age. "In a message to all Army commanders, dated March 8, 1994, Army Chief of Staff GEN Gordon R. Sullivan

unveiled the vision and methodology for building the force for the 21st century—Force XXI."13

General Sullivan understood what he had seen and not seen at the NTC 94-07 rotation. "We are beginning to define the parameter of Force XXI....TRADOC must deal with a whole series of important questions that we will strive to answer as we create Force XXI...To support the concepts of Force XXI, it is necessary to develop the means, the hardware and software; we must enable ourselves to digitize the force." 14

At this point in the digital journey, the Army realized the pitfalls of closed, stovepipe weapons system architectures. Over the next couple of years, the ADO scrambled to put its arms around the current state of affairs of digital development and produced a roadmap for the journey. Their overarching task was to integrate the traditional disparate stovepipe systems into a coherent, seamless infrastructure. The Army Digitization Master Plan (ADMP) was approved and published 1 March 1996. The ADMP establishes "the overall strategy for achieving battlespace digitization and defines the migration plans of individual battlespace systems to the Defense Information Infrastructure Common Operating Environment (DIICOE)." This document is very

thorough and provides definitive rules of compliance with the objectives of transforming an Army into the vision of Force XXI.

The major goals of the Army's digitization effort include the following:

- Acquiring and fielding a near term Force XXI Battle
 Command, Brigade-and-Below (FBCB2) system.
 - Establishing a Tactical Internet.
- Conducting AWEs to evaluate the benefits and progress of digitization efforts.
- Digitally integrating the Battlefield Operating System (BOS).
- Developing a Battlefield Information Transmission System (BITS).
 - Fielding digitized Force XXI weapons systems. 16

As each of the Program Executive Officers (PEO) responsible for the development and fielding of the primary combat arms systems evaluated the impact of this plan, they committed to different levels of compliance. As stated earlier, each branch had years of development of closed architectures that worked very well in an "intranet" environment but would require considerable redesign to comply with the ADO guidance.

"... the basic digital architecture of the M1A2 [Abrams
Tank] is valid, as evaluated by both the Army's Tank-automotive
and Armaments (TACOM) and Communications-Electronics Commands

(CECOM), [however] it needed to be modified to achieve Force XXI requirements."¹⁷ This statement by the Product Manager (PM) for the Abrams tank highlights the problem that each combat system PM faces with implementing the goals of the ADOs ADMP. The weapon system is meeting the combat developers and fields requirements. However, the system does not meet the vision of Force XXI systems.

THE CHALLENGE OF COMPLIANCE

The challenge now is to modify the architecture to meet the Force XXI objectives. Each weapon system PM must evaluate the systems architecture and in some cases, upgrades are required to existing capabilities and functions due to limited processing capability and memory of the resident mission processors.

In the case of the M1A2 Abrams Tank program, "[it] did not have the types of standards and protocols ... This disparity led to the emerging M1A2 system enhancement package (SEP)." This program was envisioned concurrently with the M1A2 production and was funded. However, due to the expense of the modification, "not even all of the Abrams ... are scheduled for upgrade to digitized capabilities. ...the objective quantity of 1079 M1A2

SEP systems is less than half the approximately 2,400 tanks that would be required by only six active division." 19

The Abrams tank program baseline and SEP program represent a microcosm of the struggle the acquisition system will have to wrestle with in order to meet the objectives of the Force XXI digitization initiatives. These challenges are not unique to the Armor and Infantry communities. Army Aviation faces the same dilemma.

The AH-64D Longbow Apache program architecture was developed to account for the plethora of obstreperous protocols emerging by different BOS. During the development phase, the architecture for digital connectivity with other systems was structured around the Improved Data Modem (IDM). This approach was envisioned by the PEO to account for the proliferation of profligate branch and service specific "intranet" type digital solutions.

The IDM is nothing more than a black box that houses up to seven electronic modules. Each slot in the IDM could theoretically house a specific modular (TACFIRE, Air Force, Marine Corps, etc) protocol. The IVIS protocol is not resident on a module, therefore, it is incompatible with the IDM architecture.

This was the Aviation vision for a flexible solution to the seamless communications nets across the digitized battlefield.

It was recognized that each branch would continue the development of their unique capability and Aviation would have to have a semi-open architecture to account for this parochial approach to digitization.

THE EMERGENCE OF AN APPLIQUÉ SOLUTION

The ADO evaluated the status of each of the primary combat arms platforms system and realized that for the Army to have situational awareness it must regulate a recrudescent range of solutions. The decision was made to have all systems utilize the Force XXI Battle Command Brigade and Below (FBCB2) system to provide a seamless flow of battle command information across the battlespace²⁰. The challenge was to install this system in legacy and developing systems.

The legacy systems had embedded, stovepipe, "intranet" command and control digital architectures. In order to have these systems participate in the Force XXI Tactical Internet with the FBCB2 functionality, they either installed the FBCB2 software into their mission computers or installed a stand alone appliqué solution. The appliqué solution included hardware which hosted

the FBCB2 software, a position/navigation capability, and an interface to a radio to transmit the data.

The ADO accurately recognized the problem FBCB2 posed for the embedded, legacy systems. "The primary integration challenge resides at the lower echelons, where existing legacy systems were originally developed to provide vertical stovepipe information flows in support of specific battlefield functional areas." 21

It was relatively easy to recognize the problem and develop cogent solutions to solve the lack of compatibility of the legacy systems to interchange situational awareness. The hard part was how to affect the programmatics. Each of the primary combat arms systems was either fielded or had recently completed modernization developmental and operational testing. Each system had plans to embed the open architecture recommended by the ADO (M1A2, M2A3 and OH-58D programs) or were tied to their current requirements documents and did not plan to embed the FBCB2 software (AH-64D and Field Artillery systems).

The drudgery was how to affect the acquisition system and solve this problem. A pithy solution was derived to withhold some of the PM funds to pay for their systems compliance to the Force XXI internet capability. "The Director, ADO, maintains control over a portion of the PM's funds until the PM provides a

suitable plan that demonstrates adherence to digitization standards and the ATA. $^{\prime\prime}^{22}$

so on the eve of the 1997 Force XXI AWE, the Army had established a standard for digital exchange of information via a tactical internet with the FBCB2 software and a recommended means to fund the solution. The solution centered around each combat system communicating digitally with either their embedded system or installing the stand alone appliqué system. "This network will provide reliable, seamless and secure communications connectivity required to support the appliqué, other command and control systems, and embedded systems" with the express purpose of providing a common picture of the battlefield in near-real time between battlefield operating systems to enhance situational awareness. 24

FORCE XXI DIGITAL ROTATION AT NTC

During March 1997, First and Fourth Brigades, 4th Infantry
Division (MECH), 1-5 Infantry (Light), and supporting Division
elements descended upon NTC to release the fury of Force XXI
initiatives. "TF XXI represented the culmination of several
smaller experiments,..., which contributed to the growing body of
knowledge about digitization and increased situational

awareness."²⁵ Even though the official TRADOC results are not published at this time, emerging results indicate that situational awareness was a resounding success. "The summary called situational awareness "the most significant achievement demonstrated during the Task Force XXI Advanced Warfighting Experiment."²⁶ There is no doubt that situational awareness was demonstrated as a winner on the NTC battlefield. However, a closer look at how the apocryphal situational awareness was achieved is required.

The Abrams and Bradley family of vehicles installed the stand alone appliqué so they could digitally communicate within the internet. They still relied on their IVIS system for "intranet" communications but utilized the appliqué for "internet" situational awareness. The AH-64D and Field Artillery did not install the appliqué, nor was the FBCB2 software installed in their mission processors. Therefore, these primary combat platforms did not connect to the tactical internet. The OH-58D Kiowa Warrior did accept the challenge of installing the tactical internet software into its mission computer. It is important to understand the wide variety of compliance with the Army's Force XXI initiatives to properly analyze the comments about situational awareness.

It is logical to expect that combat systems which installed the "horizontal" stovepipe, non-integrated appliqué system could communicate and demonstrate situational awareness. Likewise, if primary combat systems did not have the appliqué system either embedded or installed via a federated application, they would not expect to enhance situational awareness. If all the primary combat arms systems do not have a common picture of the battlefield, it is difficult to conclude that situational awareness was a clear winner.

THE CHALLENGE TO INTEGRATE AN APPLIQUÉ SOLUTION

It is important to understand the visceral challenges that lie ahead given the fact that an emerging TF XXI conclusion is that situational awareness is enhanced if all systems are sharing a common picture and information via the tactical internet.

Each combat arms branch is now wrestling with the programmatics of weapons system architecture redesign to incorporate the FBCB2 software. Each weapon system PM can not afford to install the stand alone appliqué system for a myriad of reasons. To the materiel developer and the user in the field, the only way to guarantee seamless exchange of situational awareness is via a fully integrated solution.

The Armor community's emerging thought on the non-integrated appliqué solution is, "The M1A1 with appliqué is not an objective system; our ability to operate in a digital environment can not be evaluated solely on the AWE performance of less than fully integrated prototype systems."²⁷

The Field Artillery systems did not embrace the current Force XXI tactical internet due to it's speed of service. Field Artillery's primary mission is to provide the maneuver commander with timely, accurate, and lethal indirect fires. current emphasis is to guarantee instant response to their customers. The Field Artillery can not provide the response time with the tactical internet. "In TF XXI, the fire support community took issue with the service reliability provided by the Tactical Internet. Specifically, they took issue with the speed and quarantee of service that is achievable by the current (i.e., TF XXI) version of the Tactical Internet....[it] was not stable/mature enough to meet the timelines required by the Fire Support community." Therefore, a major combat system does not intend to utilize the primary situational awareness net and will continue to utilize their own stovepipe, dedicated digital nets. "Currently, only the TCIM [Tactical Communications Interface Module] provides the features that are required to meet the speed

of service, throughput and reliability requirements identified by the Field Artillery School....the TCIM will be required as an essential component for Fire Support operations."²⁹

The Aviation systems had mixed success by Task Force XXI The AH-64D was a lethal killer on the battlefield, standards. but was not able to share its real time picture of the enemy maneuver forces due to its stovepipe architecture. "The aircraft could not dynamically join the Tactical Internet as it moved around the battlefield. This inability of aviation to dynamically join the Tactical Internet to send and receive messages (including situational awareness) restricted its operational flexibility."30 Commanders at all levels were impressed with the sophistication of the picture provided by the Fire Control Radar. However, in order to transmit that picture to other systems via the tactical internet would require a complete reengineering of the digital architecture and new mission processors with increased RAM and throughput. improvements are completely outside the scope of the current operational requirements documents and funding expectation of the program objective memorandum.

Another implication of the stand alone appliqué solution is the ergonomics of division of attention with primary display

information. The installation of the appliqué software into the IDM was not attempted due to funding and schedule constraints. Space, weight, and power requirements of the appliqué system also exceed the current capabilities of the aircraft. As discussed earlier, Army Aviation's position remains to install new modules into their resident processors. Unless the tactical internet software is miniaturized onto a card and installed into the mission processor, the AH-64D will not communicate with the tactical internet.

A frustration with a software intensive system was realized with the OH-58D Kiowa Warrior experience with embedding the appliqué software. Software updates were continuously made with the tactical internet software. Each time these software changes were made, extensive regression testing was required with the aviation platforms to ensure airworthiness and safety requirements were not exceeded. "By aggressively undertaking the challenge of embedding immature appliqué software, Kiowa provided valuable insights into the financial and schedule costs of continuous software revisions in an aircraft mission computer."³¹

FORCE XXI LESSONS LEARNED

What preliminary lessons should the Army extract from the variety of successes that the primary combat arms had operating within the Tactical Internet during the Force XXI exercise?

- 1. Unless the FBCB2 software is hosted on a module that will fit into the existing hardware architecture, major combat arms platforms will not interface with the tactical internet.
- 2. Platform Project Managers currently are not funded to make major architecture changes. They are meeting their operational requirements via stovepipe solutions. Therefore, they have no reason to change.
- 3. Department of the Army will have to allocate sufficient fiscal resources to correct this interface problem if they expect the Aviation and Field Artillery systems to participate in the Force XXI initiatives.
- 4. If all the systems are not digitized, the user reverts to an environment of "push-to-talk."
- 5. The current stand alone, federated appliqué system is only a partial solution. The only way to achieve harmonious situational awareness across the full spectrum of combat arms platforms is by fully integrating the FBCB2 into each platforms mission processors.

6. TRADOC must insist that the Army Acquisition Executive fully integrate the FBCB2 software into each platforms mission architecture. Without this fundamental change to the approved system architectures and each Operational Requirements Documents, Program Managers will not have a regulatory mandate to make changes.

WHAT MUST HAPPEN?

The Army Acquisition Executive must establish, charter, and fully fund a single Program Manager to tie each Combat Arms platform together under the Tactical Internet umbrella. The Army Acquisition Executive can empower a Program Manager to resolve each platforms technical architecture interface problems.

The ADO is not the correct executive agency to perform the function of a chartered Program Manager. The ADO has correctly transformed General Sullivan's vision into an architectural roadmap for seamless situational awareness. They must now assist the Army Acquisition Executive as he charters a PM's PM with the proper authority and funding to make General Sullivan's vision of one picture of the battlefield a reality. The Army will lose the value of digitization and situational awareness if this drastic measure is not taken.

(5510 words)

ENDNOTES

¹General Gordon R. Sullivan, "A Vision for the Future," <u>Military Review</u> LXXV, no. 3 (May-June 1995): 5.

²Ibid., 8.

³Department of Defense, <u>U.S. Army Digitization Master Plan</u>, (Washington D.C.: Defense Technical Information Center, 1 March 1996), 6-2.

⁴U.S. Army Aviation Development Test Activity. <u>Final Report</u> (Volume I) <u>Development Test II</u>, <u>Prototype Qualification Test-Government (POT-G) of the Army Helicopter Improvement Program (AHIP) OH-58D</u>, by MAJ Ralph M. Buie, May 1985, 3.

⁵CW5 (Ret) Donald Price, Operational Test Standardization Instructor Pilot, telephone interview by author, 26 February 1998.

Sullivan, 10.

⁷Dennis Steele, "Countdown to the Next Century," <u>Army</u> 46, no. 11 (November 1996): 21.

⁸Gordon R. Sullivan and Michael V. Harper, <u>Hope Is Not A</u>
<u>Method</u> with a foreword by John S. D. Eisenhower (New York: Random House, 1996

⁹LTG John E. Miller, "Force XXI - Vision for Change," foreword to <u>Military Review</u> LXXV, no. 3 (May-June 1995).

¹⁰Gordon R. Sullivan and Michael V. Harper, <u>Hope Is Not A</u> <u>Method</u> (New York: Random House, 1996), 230.

¹¹Department of Defense, <u>U.S. Army Digitization Master Plan</u>, 1-9.

 $^{12}\mbox{Gordon}$ R. Sullivan and Michael V. Harper, <u>Hope Is Not A Method</u> , 175.

¹³Thomas G. Conway, "America's Army...Into The 21st Century," Army RD&A (January-February 1995): 11. ¹⁴Gen. Gordon R. Sullivan, "Force XXI 'A New Force For A New Century'" <u>Army</u> 44, no. 5 (May 1994): 26.

¹⁵Department of Defense, <u>U.S. Army Digitization Master Plan</u>, 1-1.

¹⁶Ibid., 1-9.

¹⁷LTC George Patten and MAJ Craig Langhauser, "The World's First 21st Century Tank." <u>Army RD&A</u> (March-April 1997): 16.

18Scott R. Gourley, "Army's Force XXI Armored Maneuver Team."
Army 46, no. 7 (July 1996): 42.

¹⁹Ibid., 44.

²⁰Ibid., 5-9.

²¹Ibid., 6-8.

²²Ibid., 7-7.

²³Ibid., B-6.

²⁴Ibid., Executive Summary, 5.

²⁵Colonel Thomas R. Goedkoop and Captain Barry E. Venable, "Task Force XXI: An Overview," <u>Military Review</u>, 77, no. 2 (March-April 1997): 71.

²⁶Dennis Steele, "Task Force XXI Advanced Warfighting Experiment at NTC," <u>Army</u> 47, no. 5 (May 1997): 16.

²⁷MG George H. Harmeyer, "Post AWE Observations," <u>Armor</u>, 106, no. 4 (July-August 1997): 5.

28Robert Skertic <skerticr@ado.army.mil>, "2 STAR RRC on TI/FBCB2," electronic mail message to multiple recipients, 3 November 1997. ²⁹Jack Plant <plantj@doim6.monmouth.army.mil>, "TCIM" electronic mail message to CPT Dan Oakes <oakesd@silltcmd-smtp.army.mil>, 20 November 1997.

30 Robert Skertic electronic mail message.

³¹Program Executive Office Army Aviation, "Task Force XXI Advanced Warfighting Experiment (AWE) After Action Report and Summary", 1-3.

BIBLIOGRAPHY

- Baker, Caleb E. "The Disconnect Between the Force and the Funding." Army 45, no. 2 (February 1995): 35-38.
- Clancy, John and MAJ Daniel P. Hughes. "New Technology for Force XXI Artillery." Army 46, no. 2 (February 1996): 46-52.
- Conway, Thomas G. "America's Army...Into The 21st Century."

 <u>Army RD&A</u> (January-February 1995): 11-13.
- Davison, David A. and Steve Taulbee. "Digitizing the Battlefield." Army RD&A (May-June 1995): 49-51.
- Decker, Gilbert F. "Modernization is the Key to 21st Century Readiness." Army 44, no. 10 (October 1994): 39-44.
- Frankel, Dr. Michael S. "The 1994 Army Science Board Recommended Technical Architecture for the Digital Battlefield." Army RD&A (November-December 1994): 7-11.
- Franks, Frederick M. General, U.S. Army. "Winning the Information War Evolution and Revolution." (speech delivered at the Association of the U.S. Army Symposium, Orlando, Florida, February 8, 1994)
- Goedkoop, Colonel Thomas R. and Captain Barry E. Venable. "Task Force XXI: An Overview." <u>Military Review</u> (March-April 1997): 68-78.
- Gourley, Scott R. "The Army's Force XXI Armored Maneuver Team."

 Army 46, no. 7 (July 1996): 40-44.
- Harmeyer, MG George H. "Post AWE Observations." <u>Armor</u> 106, no. 4 (July-August 1997): 5-6.
- Hartzog, Gen. William W. and Susan Canedy. "Synergy for the Next Century." Army 46, no. 5 (May 1996): 19-22.
- Hite, Lieutenant General Ronald V. <u>United States Army Technology Programs, Fiscal Year 1997</u>. Statement before the Subcommittee on Acquisition and Technology Committee on Armed Services 104th Cong., 2d sess. Washington, D.C.: Senate Armed Services Committee, 1996.

- House, Thomas L. <u>FY 1996 Army Aviation Research, Development, Test, and Evaluation Plan</u>. St. Louis, MO.: U.S. Army Aviation and Troop Command, 1996.
- Maggart, BG Lon E. "Window to the Future." <u>Army RD&A</u> (November-December 1994): 12-13.
- Miller, LTG John E. Foreword to "Force XXI Vision for Change."

 Military Review LXXV, no. 3 (May-June 1995).
- Oder, Brig. Gen. Joseph E. "Digitizing the Battlefield: The Army's First Step to Force XXI." Army 44, no. 5 (May 1994): 36-42.
- Office of the Secretary of Defense., "Report on the Quadrennial Defense Review." Washington D.C.: Department of Defense, 1997.
- Oscar, Kenneth J. "Fielding a Versatile Army Today to Meet Tomorrow's Challenges." Army 47, no. 10 (October 1997): 31-33.
- Patten, LTC George, and MAJ Craig Langhauser. "The World's First 21st Century Tank." Army RD&A (March-April 1997): 16-19.
- Plant, Jack <plantj@doim6.monmouth.army.mil>. "TCIM."
 Electronic mail to CPT Dan Oakes <oakesd@silltcmdsmtp.army.mil>. 20 November 1997.
- Price, CW5 (Ret) Donald., Operational Test Standardization Instructor Pilot. Telephone interview by author, 26 February 1998.
- Program Executive Office Army Aviation. "Task Force XXI Advance Warfighting Experiment (AWE) After Action Report and Summary." St. Louis, MO: Department of Defense, 1997.
- Reimer, General Dennis J. <u>Army Vision 2010</u>. Washington, D.C.: U.S. Department of the Army, 1996.
- Reimer, General Dennis J. "Challenge and Change: A Legacy for the Future." <u>Military Review</u> (July-August 1997): 108-116.
- Rigby, Maj. Gen. Joe W. "Digitizing Force XXI: A Team Effort."

 Army 45, no. 5 (May 1995): 36-44.

- Roper, Major Daniel S. "Technology: Achilles' Heel or Strategic Vision." Military Review (March-April 1997): 87-92.
- Skertic, Robert <skerticr@ado.army.mil>. "2 STAR RRC on TI/FBCB2." Electronic mail message to multiple recipients.
 3 November 1997.
- Steel, Dennis. "Countdown to the Next Century." Army 46, no. 11 (November 1996): 16-22.
- Steel, Dennis. "Task Force XXI Advanced Warfighting Experiment at NTC." Army 47, no. 5 (May 1997): 14-22.
- Sullivan, Gordon R. and Michael V. Harper. <u>Hope Is Not A Method</u>. New York: Random House, 1996.
- Sullivan, General Gordon R. "A Vision for the Future." <u>Military</u> Review (May-June 1995): 5-14.
- Sullivan, General Gordon R. "Force XXI 'A New Force For A New Century'" Army 44, no. 5 (May 1994): 24-27.
- United States Army Aviation Development Test Activity. <u>Final</u>
 Report (Volume I) <u>Development Test II Prototype Qualification</u>
 <u>Test-Government (POT-G) of the Army Helicopter Improvement</u>
 <u>Program (AHIP) OH-58D</u>. By MAJ Ralph M. Buie. May 1985. 3.
- U.S. Department of Defense. <u>U.S. Army Digitization Master Plan</u>. Washington: Defense Technical Information Center, 1 March 1996.
- "Washington Report House and Senate Pass Defense Authorization Bills." Army 47, no. 8. (August 1997): 5.
- West, Togo D. Jr, and General Dennis J. Reimer. A Statement on the Posture of the United States Army Fiscal Year 1998.

 Posture Statement presented to the 105th Cong., 5th sess.

 Washington, D.C.: U.S. Department of the Army, 1997.